

## Electronic Supplementary Material

### Financing Marine Protected Areas through Visitor Fees: Insights from Tourists

#### Willingness to Pay in Chile

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#### Appendix S1: Statistical procedure

##### *Survival analysis*

Let *willingness to pay* ( $Wtp$ ) be a non negative random variable with a probability density function  $f$  and a distribution function  $F(w) = \Pr(Wtp < w)$ , which represents the probability of paying less than an amount (fee)  $w$ . We define the survival function as  $S(w) = \Pr(Wtp > w) = 1 - F(w)$ , which represents the probability of paying more than an amount (fee)  $w$ . In addition, the risk function  $h(w) = f(w)/S(w)$ . Be,  $\Lambda(w) = \int_0^w h(u)du$ , the integrated risk function which relates to the survival function in the following way:

$$S(w) = \exp(-\Lambda(w)) = \exp\left(-\int_0^w h(u)du\right)$$

Thus, in general terms, the likelihood of the survival function is defined as:

$$L = \prod_{i=1}^n f(w_i)^{\delta_i} S(w_i)^{1-\delta_i}$$

Where  $\delta_i$  is the censoring indicator of the willingness to pay.

##### *Proportional risk model*

To consider a group of predictor variables (co-variables) in survival regressions, we do it through risk functions:

$$h(w_i; X_i, \beta) = h_0(w_i) * \exp \{X_i \beta\}$$

where  $h_0()$  is the basal risk function, constant for all individuals and  $\exp \{X_i \beta\}$  plays individual risk functions according to their co-variable profile.

In this way the risk ratio of two individuals with different profiles can be expressed as:

$$\frac{h(w_i; X_i^*, \beta)}{h(w_i; X_i, \beta)} = \exp \{(X_i^* - X_i) \beta\}$$

### *Accelerated failure time model*

The accelerated failure time models are alternative parametric models to those of proportional risk. The Accelerated failure time models are defined as a linear model of the logarithm of the *willingness to pay*

$$\text{Log}(Wtp_i) = X_i \beta + \varepsilon_i,$$

Where  $\varepsilon_i$  is a random error, whose distribution defines the probabilistic behavior of *willingness to pay* (Wtp).

### *The Weibull model*

If we assume that the Wtp is a Weibull random variable,  $Wtp \sim \text{Weibull}(\lambda, \alpha)$ , whose density function is given by  $f(w; \lambda, \alpha) = \lambda \alpha w^{\alpha-1} \exp(-\lambda w^\alpha)$ , where  $\alpha > 0$  is the distribution form parameter and  $\lambda > 0$  is the pay rate. The risk function for this model is  $h(w) = \lambda \alpha w^{\alpha-1}$ .

The Weibull model can be defined in an equivalent way from the accelerated failure time model, as the linear transformation of an extreme value random variable, as presented:

$$\log(Wtp) = \beta_0 + \sigma Z,$$

where,  $Z$  is an extreme value distributed,  $\beta_0 = -\log(\lambda)$  y  $\alpha = 1/\sigma$ . Using this model  $Wtp \sim Weibull(\lambda, \alpha)$ , is defined in an equivalent way to the Weibull model.

Within the context, the Weibull regression model can be defined from the accelerated failure time model, including the linear predictor in the model, as follows

$$\log(Wtp) = \beta_0 + X\beta + \sigma Z,$$

where  $X$  is a matrix of explanatory variables of the willingness to pay, and  $\beta$ , is the vector of the model coefficients.

This way, the likelihood of the model is given by,

$$L(\beta, \lambda, \alpha) = \prod_{i=1}^n \{\exp(x_i^T \beta) \alpha t_i^{\alpha-1}\}^{\delta_i} \exp \{\exp(x_i^T \beta) t_i^\alpha\}$$

The estimation of the parameters is solved through the numeric methods internally used in software R (R Core Team, 2013).

Median WTP for Sun-sea-sand and nature-based tourists was estimated with the adjusted weibull model using average values for independent variables and the mode of education. Overall contribution from visitor fees at Lafken Mapu Lahual were estimated by aggregating the median maximum park fee that respondents were WTP across predictions of annual arrivals to the surrounding areas of the MPA (10 000 visitors: SERNATUR 2008).

Thus we associated welfare estimates from tourists WTP to actual fees.

## REFERENCES

R Core Team 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.

SERNATUR: Servicio Nacional de Turismo. 2008. Estadísticas de Alojamiento Turístico  
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